

# Risk Management and Consumer Participation in Medical Decision Making

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THE demand by consumers for a voice in decisions which affect their lives can be observed in many sectors of Western society. The health industry is one of these, as practitioners in public health can well testify. The concept of consumer sovereignty which is one of the basic premises of the free market system has seen little application in health care decision making.

Differences between physicians and patients on the values associated with different courses of medical and preventive actions are to be expected. The physician views the world through a web of medical ethics, professional norms, and a subjective view of the patient's life situation which the physician obtains in increasingly brief

glimpses during his harried schedule of appointments. The consumer-patient views the world through his experiences and may give differing importance to such concerns as absence from his job, financial sacrifice, or absence from his family.

The physician faced with a choice among alternative courses of medical action for a patient would benefit from greater knowledge of the attitudes of the patient toward the possible outcomes associated with each course of action and toward associated risks. Our purpose is to investigate choices involving risk in medical decision making and to identify factors and strategies which may improve the quality of direct and indirect consumer participation in medical decisions. In addition, we will explore possible research and development directed to such improvements.

The questions of risk and consumer participation concern the public health sector in two ways: first, in preventive campaigns, such as mass immunization in schools, decisions are often made for the public without reference to its preferences among risk alternatives (should the public assume the risk associated with immunization or the deferred risk of contracting the disease?); second, the public health sector must assume major re-

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sponsibility in preparing both physicians and the public for their new functions in the future health care system.

Medical risk decision situations are defined as circumstances in which alternative courses of action are associated with sets of possible specific outcomes, each of which occurs with a known probability. As an example, consider the decision to undergo eye surgery. One's choice lies in having an operation which gives a 30 percent chance of complete recovery of sight and a 70 percent chance of complete blindness or having non-surgical treatments which invariably recover 50 percent of eyesight. With such odds, a risk taker may prefer to gamble on surgery while a risk averter might possibly choose the nonsurgical treatment.

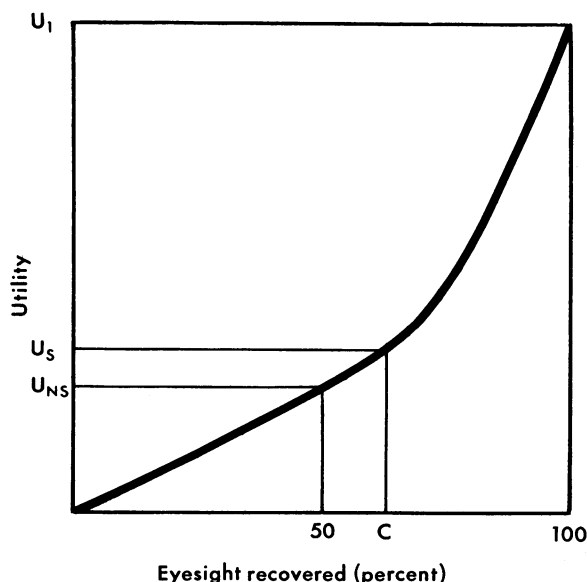
Von Neumann and Morgenstern have suggested that a rational decision maker would assign utilities to the various outcomes and then maximize the expected value of the utility (1). When probabilities are unknown, the choice is conceptually far more complicated since it is not clear what constitutes a reasonable criterion for optimality (2-4). However, for the most frequently encountered situations requiring a decision, one may assume the existence of a subjective probability distribution which reflects the beliefs of the decision maker (5).

Figures 1 and 2 reflect possible characterizations of risk-taking behavior and risk-averting behavior, respectively, for a Von Neumann utility function. For convenience, the eye surgery example previously mentioned is used in figures 1 and 2, although any medical situation involving risk would suffice.

In figure 1, the horizontal axis represents the percentage recovery of eyesight and the vertical axis represents utility. The curved heavy line provides for the risk taker the utility associated with differing degrees of eyesight recovery. Thus, for the nonsurgical alternative which affords certainty of 50 percent eyesight recovery, there is an associated utility  $U_{NS}$ .

For the surgical alternative if the outcome is complete blindness, zero utility is associated with the outcome; if the outcome is complete recovery, a utility  $U_1$  is associated. The utility associated with the surgical alternative can be computed by multiplying the utility of each outcome by the probability of its occurrence. Thus the utility of the surgical alternative,  $U_s$ , is simply  $0.7 \times 0 + 0.3 \times U_1$  which reduces to  $0.3U_1$ . Plotting  $U_s$

**Figure 1. Risk-taking patient**



on the vertical axis we find that in order for the nonsurgical alternative to produce as much utility as the surgical alternative, the percentage of eyesight recovery from this alternative must be higher than that associated with the point C (technically recognized as the certainty equivalent point).

The risk averter, however, will view the situation differently. The construction of figure 2 is similar to that of figure 1. The shape of the utility curve for the risk averter has reverse curvature from that of the risk taker. Thus, the utility associated with the nonsurgical alternative is  $U_{NS}$ . The utility,  $U_s$ , associated with the surgical alternative is computed as before at  $0.3U_1$ . This time, however, because of differences in the utility curves, the nonsurgical alternative is preferred. Thus it can be seen that, given the same set of alternatives, different decisions may occur among consumers.

### Delegation and Participation in Decisions

The choice of treatments lies in resolving the discordant risk-preference patterns of the physician and the patient. Often in delegating powers of decision to the professional, the patient, without intending to do so, delegates to the physician the right to define the objectives of the patient, that is, his utility function.

It has been demonstrated empirically in numerous studies that urgency ratings of the consequences of health conditions vary between consumers and physicians. One study, in analyzing

referrals from a school health program, hypothesized that the physicians' urgency ratings would correspond to the parents' ratings. However, the results indicated that the physicians' ratings were almost totally unrelated to those of the parents (6). Lack of response from parents reflected their legitimately different evaluation of preferences. More information was not likely to change their decisions. Compliance with physicians' instructions seemed to increase with parent-physician interaction and with an increase in the parents' perceived severity of conditions (6).

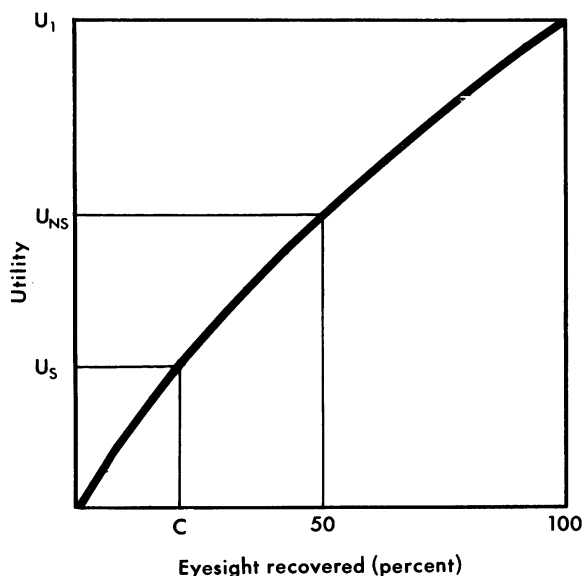
One may consider the index guiding the decision as a weighted average of both patient's and physician's preferences. The weights are associated with the "degree of delegation." The range will vary as a function of the interaction of the physician and the patient. For example, in detached health behavior, such as voting on health issues, the consumer assesses the information supplied by the professional and assigns weights to preferences between risky choices independently of the physician's opinion. Once a physician is contacted, the relationship becomes one in which the physician's preferences often dominate. The degree of delegation is also a function of the patient's health knowledge, that is, his perception of the probabilities of contracting a condition, his valuation of the credibility of the physician, and his perception of probable consequences.

The general public finds it difficult to judge the quality of medical performance with any degree of assurance. Current concepts of health education which center on preventive measures and presymptomatic referral do not contribute to the decision making abilities or the interactive abilities of the consumer once he enters the medical decision situation. Many health education efforts merely increase, unintentionally, the imbalance in social status between patient and physician. The high level of social standing of the medical profession (7, 8) leads to a broad acceptance of the physician's services and great compliance with their advice. Thus the consumer's participation in health decisions has been small in recent years (9).

### How Can Decision Making be Improved?

The strategy to improve medical decision making and make it more responsive to consumer needs concerns practicing physicians, future physicians (students), the general public, and public health authorities. To improve the decision mak-

**Figure 2. Risk-averting patient**



ing process of practicing physicians, action may be taken to (a) improve the flow of information to the physician and (b) supply the physicians with simple aids to decision, incorporating research results on consumer preferences.

As was noted in the preceding sections, certain segments of the physician population may make decisions with inadequate information. The tight time budget of the practicing physician often reduces his ability to search for new developments and to update his information base. Identification of weak links in the diffusion of medical information (target population) and development of new modes of communication to the physician may contribute significantly to the improvement of medical decision making. In addition, the physician must be equipped with aids to make decisions. While efforts in this direction have been focused recently on computer diagnostic aids (10, 11) and on data retrieval, these decision aids are presently uneconomical for mass use by physicians.

However, development of logoscopes, nomographs, keysorts, or similar devices may temporarily fill the gap. Logoscopes are a class of manual devices with which several variables can be selected and an associated dependent variable identified. They rapidly perform mechanical pattern recognition. Logoscopes which are updated periodically will assist the physician in preliminary diagnosis, choice of drugs, and decisions regarding referrals.

For example, a logoscope which identifies risk preferences for a group of patients may allow the physician to respond to the need of a particular patient without a forbidding search process. The logoscope, or in future years a centralized computerized medical information center, will also enable the consumer to participate more actively in the choices made in his health care.

Flexibility of choice improves the utility of the consumer and increases the efficiency of the allocation of resources in the economy. Present systems of health care and health education programs tend to ignore this concept. Historically, free choice has been justified on account of externalities. For example, one case of infectious disease may have undesirable consequences for the entire community. The person, in making his choices, does not take these consequences into account. The differences between private and public marginal utility are cited by economists as a possible justification for revocation of consumers' sovereignty.

Information on the nature of health decisions and the ability to assess information on risk should become important elements in health education. The consumer should learn that the scope of his involvement in health decisions is significant. The trade-off between risks, length of hospitalization, and type of treatment is only one important area of choice in which consumer participation should be encouraged. Moreover, both physicians and consumers should be educated to understand the nature of joint decision making under risk.

To facilitate the strategies discussed in the preceding sections, an integrated approach to the study of medical decision making should be adopted. A proposal for such a study follows.

### **A Proposal for an Integrated Approach**

This proposal, which is being implemented by a group of physicians and management scientists in the Health System Group at the University of British Columbia, consists of a number of interlocking studies concerned with medical decision making. The populations involved in these studies are physicians, consumers of medical services, and medical students (who represent future physicians). A set of studies involving only one of these populations could be done as a separate effort with its own set of immediate impacts for improving health care. However, coupling of the

studies makes it possible to examine the behavioral aspects and normative implications of the medical decision making process.

Figure 3 summarizes the studies embodied in this research and development plan. The figure summarizing the project categorizes the research methodology according to the behavioral and normative considerations for each of the three populations.

Physicians constitute one of the populations to be studied. The vehicle for studying the behavioral aspects of physicians' decision making will be survey and sociometric techniques. Information about modes of medical decision making, such as risk aversion and diagnostic and therapeutic habits for selected diseases, will be collected and coupled with data concerning physicians' characteristics (that is, educational background, experience, or institutional affiliation). This coupling will be carried out through canonical analysis techniques. Special attention will be paid to flows of medical information among and to physicians. This part of the survey will consist of a sociometric study of physicians (that is, types of journals read, conferences attended, and communication with other physicians for consultation and advice).

The normative aspects of physicians' decision making will consist of the use of Bayesian probability estimates, construction of decision trees, and trade-off analysis. Data will be collected through the cooperation of a panel of experienced physicians based in a university medical center. These techniques have been tested extensively.

With further reference to figure 3, the population study of consumers will be conducted through a survey. The study will consist of interviews designed to identify consumers' preferences and knowledge with regard to health care, risk taking or aversion, attitudes toward physicians, and interpersonal competence as well as data on socioeconomic and demographic characteristics of the interviewees. A subsample of these consumers will be selected for analyses of their decisions (trade-off analysis, beliefs in their susceptibility to selected medical problems, and estimates of the seriousness of those medical problems). The results of these two component studies will be matched with the respective studies of physicians.

The third battery of studies will involve senior medical students. The main purpose of these

**Figure 3. Organization of the study**

Populations studied	Methodology and specific research methods	Variable clusters	Selected variables
Physicians	Behavioral. Survey and sociometric study	1. Physicians' characteristics and information diffusion	Education, experience, location, institutional affiliation, time allocation (for example, hospital/home/continuing education), psychological attributes (for example, cosmopolitanism), information flows among physicians
		2. Physicians' decisions	
			Outcome likelihoods for selected diseases; attitudes toward risk; perceptions of consumers' preferences
	Normative. Panel of experienced physicians	3. Trade-off analysis on selected medical decisions. Construction of decision trees	Bayesian probability estimates of disease outcomes and disease trade-offs (for example, for tonsillectomy or for hernia)
Consumers	Behavioral. Survey	4. Health knowledge and attitudes toward risk	Consumers' preferences, risk acceptance or aversion, attitude toward physicians, interpersonal competence
	Normative. Decision analysis with a subsample of the aforementioned survey	5. Outcome of trade-off analysis on selected medical diseases	Bayesian probability estimates of disease outcomes and disease trade-offs
Medical students	Behavioral. Small group of laboratory-controlled experiments	6. Characteristics in risk-taking decisions	Cognitive, judgmental, behavior-chance, and skill aspects; sequential decision making; situational circumstances; psychological determinants of need for information; organizational factors

studies is to develop training aids for medical education (fig. 4). The research methodology in this set of studies will be based on experiments with small groups of students in a laboratory setting. The variables to be studied will include (a) judgmental behavior ("category width"), (b) ability to control situations, (c) determinants of need for information, (d) sequential decisions, and (e) situational circumstances (achieved by

changing the environment or the context of the experiment).

The utility and impact of all of these studies for health care are summarized in figure 4 in a matrix format. The boxes (1-1, 2-2, 3-3, 4-4, 5-5, and 6-6) or cells on the main diagonal represent the benefits resulting from each of the studies taken as a separate unit. For example, cell 1-1 delineates the benefits to be derived from

the study and analysis of behavioral characteristics of physicians' decision making. These benefits are shown in the cell as the identification of efficient patterns of diffusion of information and as the appropriate selection of a target population of physicians for intensive continuing education.

The cells not on the main diagonal indicate the benefits derived by coupling two studies. For example, cell 1-4, 1 referring to physicians' behavioral aspects of decision making and 4 to consumers' behavioral aspects, indicates as the benefit the identification of criteria for matching consumer groups with compatible physicians (that is, the physicians' characteristics required for effective delivery of health care in rural areas).

Cells with black backgrounds represent research benefits of paramount importance for the relatively immediate improvement of health care or for providing answers to questions which will arise in conjunction with predicted changes in health care systems; for example, problems of priority determination in health care. The research will lead to the development of training aids for medical education and aids for decision making.

Training aids for medical education, such as simulations and games, will be designed to enable medical students to develop their decision making capacities and increase their sensitivity to costs and benefits of particular diagnostic and therapeutic paths. These simulations and games will also increase the students' sensitivity and responsiveness to patients' needs. The use of simulation and gaming techniques in professional training suggests the effectiveness of such tools, especially for continuing professional education, as they combine dramatic appeal with the richness of interactive learning situations.

The games and simulations will use as inputs the information on variations in consumer preferences and the normative decision models for physicians which will be developed in earlier studies. The battery of experiments with small groups will provide the necessary psychological inputs for the design of effective learning modes (content and environment choice for the games).

To complement the development of training aids, it will also be possible to create tools for everyday use by physicians. One tool could be logoscopes for identification of consumer preferences. Basically these are cross-referenced tables derived from the consumer preference inventory (fig. 4, box 5-5). This table would relate clusters

of attributes (age, sex, economic class, or other considerations) to consumer preferences. While the complexity and detail of the consumer preference inventory could not be included without prohibitively increasing the time required to search for information, nevertheless, major clusters of attributes could be included.

Another tool could be logoscopes for selected diagnoses. These logoscopes would identify the expected consequences of alternative treatment for a medical condition as determined by a panel of experienced physicians. For instance, if the patient has a sore throat, the consequences of each course of action could be summarized in terms of the expected dollar cost of drugs and treatment, the expected number of days restricted to bed, and the probability of an adverse drug reaction.

The combination of decision making aids on consumers' preferences and on the expected consequences of medical action on selected diseases would enable physicians to choose therapeutic procedures in keeping with the will of the consumers. The logoscopes mentioned in this paper are manual devices and necessarily demand certain simplifications for rapid manual accessibility. As on-line computer facilities become more available at reasonable cost, more sophisticated forms of these decision making aids will be possible.

## Conclusions

This paper analyzes the medical decision making process with an emphasis on risk management and consumer participation. To improve medical decision making processes, a plan of research and development leading to the creation of decision and training aids is outlined. Public health authorities must assume the responsibilities for implementing the strategies outlined. Their implementation entails the provision of aids to decision making which will equip both consumers and physicians to participate in health care systems in the future.

## REFERENCES

- (1) Von Neumann, J., and Morgenstern, O.: *Theory of games and economic behavior*. John Wiley & Sons, Inc., New York, 1964.
- (2) Arrow, K. J.: Utilities, attitudes, choices: A review note. *Econometrica* 26: 1-23 (1958).
- (3) Luce, R. D., and Raiffa, H.: *Games and decisions*. John Wiley & Sons, Inc., New York, 1957.
- (4) Edwards, W.: The theory of decision making. *Psychol Bull* 51: 380-417, July 1954.

**Figure 4.**

Physicians	1 Physicians' characteristics and information diffusion	Identification of efficient paths for diffusion of information; choice of target population of physicians for intensive continuing education	
	2 Physicians' decisions	Identification of appropriate forms of disseminating information (for example, continuing education, consultation, conferences) to affect modes of medical decision	Identification of latent priority systems used by physicians in order to increase awareness of these priority systems and thus facilitate physicians' self-reevaluation
	3 Trade-off analysis on selected medical decisions. Construction of decision trees		Identification of discrepancies between normative and customary probability estimates of disease outcomes for selected diseases in order to refocus continuing education programs
Consumers	4 Health knowledge and attitudes toward risk	Criteria for matching consumer groups with compatible physicians (for example, which physicians would function effectively in the northern areas of British Columbia?).	
	5 Outcome of trade-off analysis on selected medical diseases		
Medical students	6 Characteristics in risk-taking decisions		

Development of normative decision trees for selected diseases			
Improvement of service responsiveness through modification of weightings of physicians' trade-offs in light of consumers' attitudes	Identify areas for potential involvement of consumers in medical decisions		
Identify areas of discrepancy between professional norms and consumers' preferences to obtain information for reevaluation by the British Columbia Medical Association		Develop inventories of consumers' preferences that physicians can use in decision making	
Identify the normative data base for the design of training aids		Develop training aids (for example, lecture materials, decision making games) to increase the responsiveness of medical students to consumers' needs and preferences	Design appropriate training aids to increase the decision making capabilities of future physicians (for example, decision making games)



- (5) Savage, L. J.: The foundation of statistics. John Wiley & Sons, Inc., New York, 1954.
- (6) Cauffman, J. G., Petersen, E. L., and Emrick, J. A.: Medical care of school children: Factors influencing outcome of referral from a school health program. *Am J Public Health* 57: 60-73, January 1967.
- (7) Reiss, A. J.: Occupations and social status. Free Press of Glencoe, New York, 1962.
- (8) Hodge, R. W., Siegel, P. M., and Rossi, P. H.: Occupational prestige in the United States, 1925-1963. In *Class, status, and power: Social stratification in comparative perspective*, edited by Reinhard Bendix and Seymour M. Lipset. Ed. 2. Free Press of Glencoe, New York, 1966, pp. 322-334.
- (9) Feldman, J. J.: The dissemination of health information. A case study in adult learning. Aldine Publishing Co., Chicago, 1966.
- (10) Vishnevsky, et al.: Machine diagnostics and information search in medicine. M.I.T. Press, Cambridge, Mass. In press.
- (11) Ham, T. H.: Medical progress. Medical education at Western Reserve University. *New Engl J Med* 267: 868-874, Oct. 25, 1962; 916-923, Nov. 1, 1962.

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Our purpose is to suggest a research scheme to investigate choices involving risk in medical decision making and to identify those factors and strategies which may improve the quality of con-

sumers' participation in medical decisions.

Medical risk decision situations are defined as circumstances in which alternative courses of treatment are associated with sets of possible outcomes, each of which occurs with known probability. To obtain this information a panel of expert physicians will be consulted.

Consumers differ greatly in their willingness to accept risk, and they differ in the value which they associate with specific outcomes. Their attitudes can be determined through survey techniques.

A series of interlocking research efforts is recommended

for this study. This research involves medical students, consumers, and physicians to examine the normative and behavioral aspects of medical decision making under risk. Implementation of the results will require the efforts of public health authorities.

The results of the aforementioned efforts can be used to develop educational games and simulations for medical students to increase their responsiveness to consumers' preferences. Another objective of the research described is to develop decision making aids so that practicing physicians can use the empirical results of such studies.